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EFFECT OF PULSED STRAY MAGNETIC FIELDS ON THE INJECTION STORAGE RING

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When the beam in the main ring reaches 200 BeV, there will be about 2500 amperes circulating in the magnet bus system. The busses must be at least 15 cm apart, amd will be less than 1.5 m from the injection ring. The stray field at the ring location will then be of the order of 3 gauss at the ring location, and if the magnet of the ring is 15 cm wide, the iron must carry about 100 guass-cm^2 of flux per cm of length. This is carried by the iron yoke which will be a centimeter thick on each side, so that the peak pulsed flux density in the iron is of the order of 50 gauss (twice this at 400 BeV).

The relevant value of the iron permeability to use to calculate the pulsating H field in the iron (which will, with a "picture frame" magnet, equal the pulsating B field in the gap) is the incremental permeability. The iron is driven around a minor hystresis loop which looks like a leaf on a tree branch when graphed on a plot of the magnetization curve of the iron. According to Bozorth[1], the incremental permeability for small excursions is less than or equal to the initial permeability for small values of B or H. He gives values of this parameter for a variety of magnetic

[1] Bozorth, "Ferromagnetism," D. Van Nostrand 1951, pp. 489-546.

materials--the two of interest being $\mu_i = 80$ for unannealed iron and $\mu_i = 200$ for annealed iron. Thus the pulsed field in the gap of the storage ring will be of the order of a half a gauss (one gauss at 400 BeV).

This appears excessive, and it is doubtful that a change in magnetic materials would improve the situation appreciably without a considerable cost increase. The obvious solution is to enclose the booster storage ring magnet in an iron pipe with an air gap of an inch or so all around.

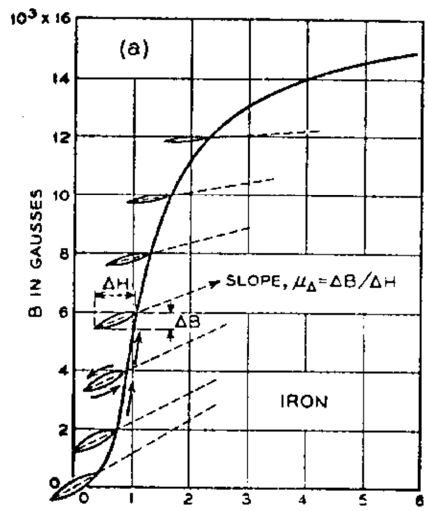

Fig. 1. Magnetization curve from Bozorth showing minor loops.